



Dwell Time and Psychological Screening Outcomes Among Military Service Members With Multiple Combat Deployments

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14. ABSTRACT The conflicts in Iraq and Afghanistan have been the longest sustained military operations in U.S. history. To meet operational demand, many service members have had to deploy multiple times to these combat zones. The effect of dwell time, or the period of time between deployments, has recently gained attention because some studies have found that longer dwell times are protective against combat-related psychological outcomes. The objective of this study was to examine the association between dwell time and psychological morbidity, while accounting for combat exposure. U.S. Marines with two combat deployments between 2005 and 2008 were identified from electronic deployment records. Those who had screened positive for posttraumatic stress disorder and depression, and had received a referral for mental health services were identified from the Post-Deployment Health Assessment. For the final study sample of 3512 Marines, dwell time was calculated as time between deployments, and was analyzed as a ratio over length of first deployment. After adjustment for all covariates, there was an interaction (p value = 0.01) between dwell time and combat exposure on mental health referral outcome. For personnel with maximum reported combat exposure, longer dwell times were significantly associated with a 49???92% reduced odds of mental health referral. Longer dwell times may be protective against combatrelated psychological outcomes. Since multiple deployments are likely to be the norm rather than the exception in future military operations, the concept of regulating dwell time, particularly for those with greater risk of combat exposure, should continue to be explored.					
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Dwell Time and Psychological Screening Outcomes Among Military Service Members With Multiple Combat Deployments

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ABSTRACT Recent studies have found that longer dwell times, or the period of time between deployments, may be protective against combat-related psychological outcomes. The purpose of this study was to examine the association between dwell time and psychological morbidity, while accounting for combat exposure. U.S. Marines with two combat deployments between 2005 and 2008 were identified from electronic deployment records. Those who screened positive for post-traumatic stress disorder and depression, and who were referred for mental health services were identified from the Post-Deployment Health Assessment. For the final study sample of 3,512 Marines, dwell time was calculated as time between deployments, and was analyzed as a ratio over length of first deployment. After adjustment for all covariates, there was an interaction ($p = 0.01$) between dwell time and combat exposure on mental health referral outcome. For personnel with maximum reported combat exposure, longer dwell times were associated with a 49% to 92% reduced odds of mental health referral. Longer dwell times may be protective against combat-related psychological outcomes. Because multiple deployments are likely to be the norm in future military operations, regulating dwell time, particularly for those with greater risk of combat exposure, should continue to be explored.

INTRODUCTION

Military deployment to combat-affected areas is a known psychological stressor.¹ Research from the Persian Gulf War and the recent military conflicts in Iraq and Afghanistan has shown there is an increased risk of post-traumatic stress disorder (PTSD),²⁻⁴ depression,^{2,5,6} and alcohol abuse⁶⁻⁸ in deployed personnel relative to their nondeployed counterparts. Less studied are the effects of the relatively recent phenomenon of multiple combat deployments, which are a hallmark of current military conflicts due to extended operational commitments.⁹ In one recently published analysis, approximately 1 out of 4 U.S. Marines had experienced more than one deployment to a combat zone.¹⁰

The possible cumulative effect of multiple deployments, or more than one deployment to a combat zone, is a rela-

tively new area of investigation, with most of the literature on the subject published within the last few years. Work conducted by the Mental Health Advisory Team (MHAT), which collected data anonymously from soldiers currently deployed to Iraq and Afghanistan, was the first to document a deleterious effect of multiple deployments.¹¹ The most recent MHAT survey found that 14% of soldiers with one deployment screened positive for a psychological problem compared with 22% and 33% after two and three deployments, respectively.¹² Similarly, a study by Reger et al¹³ found a 64% increased odds of screening positive for PTSD in soldiers with two deployments compared with single deployers. Similar trends have been identified in other military populations as well, including Air Force personnel,¹⁴ Army National Guard,¹⁵ and Marines.¹⁰ Conversely, a study among British military personnel did not find a significant association between multiple deployments and mental health outcomes. Military personnel with more than one deployment in this study had shorter individual deployment durations, which may have reduced overall exposure to traumatic wartime experiences.¹⁶

Even less literature exists on the possible mediating effect of dwell time, or the length of time at home between

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deployments. It has been suggested there may be a benefit in the establishment of a standard length of dwell time before a service member can be deployed again, in effect allowing for a mental decompression period that may allay the negative effects of cumulative combat stress. In fact, former Secretary of Defense Robert Gates and Senator Jim Webb have previously supported such a policy.^{17,18} A recently published report examined male Marines with two deployments of average length and found that longer dwell times were associated with lower odds of PTSD.¹⁰ An MHAT survey also assessed dwell time and found fewer mental health problems among soldiers with at least 24 months of dwell time.¹⁹ In contrast, a recent analysis by the Armed Forces Health Surveillance Center found that increased dwell time was associated with a greater risk of mental health outcomes; however, the study did not account for many factors, including service-related differences, previously diagnosed mental health disorders, combat exposure, and length of deployment.²⁰ These mixed findings highlight the need for further research in this area. If dwell time is indeed found to be protective, then the development of a policy for minimum dwell-time requirements would be an intervention with potentially high population-level impact for the military.

The purpose of this study was to examine the effect of dwell time on psychological screening outcomes among U.S. Marines with two combat deployments. This study aimed to extend previous work¹⁰ by incorporating self-reported health information and adjustment for combat exposure. It was hypothesized that longer dwell time would be associated with lower rates of psychological morbidity.

METHODS

Study Sample

The study sample included active duty U.S. Marine Corps personnel identified from electronic deployment records maintained by the Defense Manpower Data Center (DMDC). Criteria for inclusion and exclusion were mostly duplicated from previous work.¹⁰ To be eligible for the study the following criteria were applied: (1) two deployments between January 2005 and December 2008 to Afghanistan, Kuwait, or Iraq; (2) both deployments of average length, identified previously for Marines as 4 to 8 months¹⁰; (3) completed a Post-Deployment Health Assessment (PDHA) within 60 days of the end of their second deployment²¹; and (4) exposed to combat during second deployment, indicated by endorsing at least one of the three combat exposures from the PDHA. The PDHA is a health screening questionnaire given to returning service members to identify current health concerns, and it has been used in previous research to identify population-level psychological screening rates.^{22,23} The combat exposure questions ask whether the service member was exposed to dead or wounded bodies, had discharged his or her weapon, or felt in danger of being killed. Initially 5,165 personnel were identi-

fied meeting these criteria. Because we were assessing psychological outcomes, we excluded personnel with an International Classification of Diseases 9th Revision, Clinical Modification code²⁴ between 290 and 319 (excluding 305.1 [tobacco addiction]), indicating a mental health diagnosis before the beginning of the second deployment ($n = 514$). Other exclusion criteria included having more than two deployments ($n = 1,110$) and women due to low sample size ($n = 39$). The final study sample consisted of 3,512 Marines. This study was approved by the Institutional Review Board at Naval Health Research Center, San Diego, California.

Deployment and Dwell Time

Deployment dates were identified from the electronic DMDC deployment records, and deployment time was calculated as the start date of deployment subtracted from the end date for each of the two deployments. This resulted in two variables reflecting days deployed for both first and second deployment. To account for the variability in time points at which the PDHA is completed, another variable was created to reflect number of days deployed during the second deployment before PDHA completion, since the PDHA could be completed while still on deployment. This variable was termed "time to PDHA" and was used in multivariate analysis. Dwell time was calculated by subtracting the end date of the first deployment from the start date of the second deployment. A variable was then created reflecting dwell time relative to first deployment length and was termed dwell-to-deployment ratio (DDR). As per previous research, the DDR was categorized as <1:1, 1:1, and 2:1. The <1:1 ratio represents a shorter dwell time or time spent at home compared with the time deployed, 1:1 represents equal dwell and deployment time, and the 2:1 ratio represents longer dwell time (at least two times longer) relative to the length of the first deployment.

Outcome Ascertainment

Three separate outcome variables were assessed in the analysis: screen-positive PTSD, screen-positive depression, and mental health referral. A screen positive for PTSD was identified from the 4-item PTSD screening instrument present on the PDHA.^{25,26} It asks "Have you ever had any experience that was so frightening, horrible, or upsetting that, in the past month, you . . .", and then queries the service member on four PTSD symptoms: hyperarousal ("were constantly on guard, watchful, or easily startled"), nightmares ("have had any nightmares about it or thought about it when you did not want to"), feeling detached ("felt numb or detached from others, activities, or your surroundings"), and avoidance ("tried hard not to think about it or went out of your way to avoid situations that remind you of it"). As per previous research, answering "yes" on any two of the four questions indicated a PTSD screen positive.²² The PDHA also contains a 2-item depression screening instrument derived from the Patient

Health Questionnaire.²⁷ The question asks "Over the last 2 weeks, how often have you been bothered by any of the following problems? Little interest or pleasure in doing things (none/some/a lot); feeling down, depressed, or hopeless (none/some/a lot)." Endorsing either of the two questions as "a lot" indicated a positive screen for depression. Following completion of the PDHA, a clinician reviews the results with the service member present and may make recommendations for referrals, which are recorded on the PDHA. Referral for mental health services was abstracted from the PDHA and used as an outcome for this analysis.

Covariates

Demographic variables were identified from electronic DMDC records. Military rank was classified as E1–E5 or E6 and higher, and marital status as married or not married. Years of age were dichotomized into 18 to 24 or 25 and older. Combat exposure during the second deployment was ascertained from the PDHA. The number of positive responses to the three combat exposure questions was summed, and the final combat exposure variable was left continuous reflecting one, two, or three combat exposures. Military occupation, identified from Department of Defense occupational codes, was abstracted from DMDC records.²⁸ Occupation was categorized as infantry

or other. Infantry occupations included enlisted infantrymen and officers listed as tactical operations officers.

Statistical Analysis

All analyses were conducted using SAS statistical software, version 9.2 (SAS Institute, Cary, North Carolina). Descriptive statistics were presented and stratified by DDR, and χ^2 tests were used to test for differences. Crude rates of PTSD, depression, and mental health referral were graphically presented and compared using χ^2 tests across levels of DDR. Multivariate logistic regression modeling was used to identify the association between DDR and each of the three outcome variables. Adjusted odds ratios (OR) and 95% confidence intervals (CI) were presented, and the Hosmer–Lemeshow test was used to assess model fit with an α level of 0.10. Because of the strong relationship previously identified between combat exposure and psychological outcomes,³ the interaction between DDR and combat exposure was tested for each outcome variable with an α level of 0.05.

RESULTS

Descriptive characteristics for the study population of 3,512 Marines are shown in Tables I and II. Because the deployment

TABLE I. Deployment and Dwell-Time Characteristics for the Study Population, U.S. Marines, 2005–2008 ($N = 3,512$)

Deployment Variable	Median	Interquartile Range	Range
First Deployment Time (Days)	207	198–211	120–240
Second Deployment Time (Days)	205	202–207	123–239
Time to PDHA Response (Days)	178	169–187	93–270
Dwell Time (Days)	338	246–367	80–1,543
DDR ^a	1.64	1.19–1.95	0.44–12.37

^aDDR calculated as dwell time divided by first deployment time.

TABLE II. Population Characteristics by Dwell-to-Deployment Ratio, U.S. Marines, 2005–2008

Characteristic	Dwell-to-Deployment Ratio			<i>p</i>
	<1:1 ($n = 645$)	1:1 ($n = 2,010$)	2:1 ($n = 857$)	
Age, Years, No. (%)				<0.001
18–24	516 (80.0)	1,548 (77.0)	543 (63.4)	
25+	129 (20.0)	462 (23.0)	314 (36.6)	
Rank, No. (%)				<0.001
E1–E5	575 (89.2)	1,752 (87.2)	676 (78.9)	
E6+	70 (10.8)	258 (12.8)	181 (21.1)	
Married, No. (%)				<0.001
No	406 (62.9)	1,147 (57.1)	333 (38.9)	
Yes	239 (37.1)	864 (42.9)	524 (61.1)	
Infantry Occupation, No. (%) ^{a,b}				<0.001
No	276 (42.9)	634 (31.6)	441 (51.9)	
Yes	368 (57.1)	1,372 (68.4)	409 (48.1)	
Combat Exposures, No. (%)				<0.001
1	221 (34.3)	814 (40.5)	453 (52.8)	
2	184 (28.5)	655 (32.6)	291 (34.0)	
3	240 (37.2)	541 (26.9)	113 (13.2)	

^aInfantry includes enlisted infantry occupation and tactical operations officers. ^bMissing data $n = 644$, $n = 2006$, and $n = 850$ for <1:1, 1:1, and 2:1, respectively.

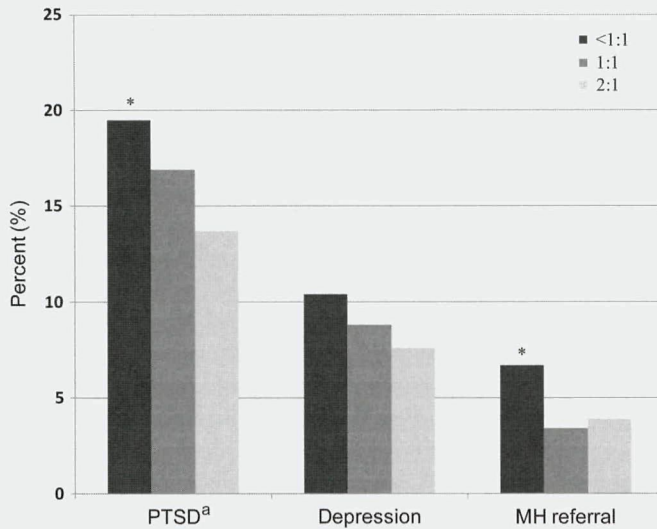


FIGURE 1. PTSD, depression, and mental health referral rates by DDR, U.S. Marines, 2005–2008 ($N = 3,512$). * $p < 0.01$ for χ^2 test across DDR categories. ^a $n = 48$ were excluded due to missing PTSD data. MH, mental health.

time was restricted to 4 to 8 months, the median lengths for first and second deployments were similar at 207 and 205 days, respectively. Time to PDHA response was less than the median of second deployment time (178 days), which reflects the fact that many service members complete the PDHA before the end of deployment. Dwell time was, on average, longer than first deployment length, with a median of 338 days. The median DDR was 1.64, with an interquartile range of 1.19 to 1.95. Overall, 18.4% ($n = 645$) had a DDR of <1:1, 57.2% ($n = 2,010$) of 1:1, and 24.4% ($n = 857$) a DDR of 2:1; thus, over 80% of the sample had at least as much dwell time as first deployment time. When examining descriptive characteristics across DDR categories, there were many significant differences. Those in the lowest DDR category of <1:1 had the highest frequency compared with

other DDR categories of being aged 18 to 24 years (80.0%), E1–E5 rank (89.2%), and not married (62.9%). Self-reported combat exposure differed significantly across categories of DDR ($p < 0.001$). The percentage of those reporting all three combat exposures was 37.2%, 26.9%, and 13.2% for DDR categories <1:1, 1:1, and 2:1, respectively.

Among the study population 16.6% ($n = 576$) screened positive for PTSD and 8.8% ($n = 308$) for depression, while a lower rate, 4.1% ($n = 145$), were referred to mental health services. Figure 1 displays outcome rates stratified by DDR. The sample size for the PTSD outcome was slightly smaller due to missing data ($n = 48$). Those with the lowest DDR of <1:1, or shortest length of time at home, had the highest rates of PTSD (125/640; 19.5%), depression (67/645; 10.4%), and mental health referral (43/645; 6.7%). χ^2 testing indicated statistical differences for PTSD ($p < 0.01$) and mental health referral ($p < 0.01$) across DDR categories.

The results of multivariate logistic regression are shown in Tables III and IV. After adjustment for all covariates, DDR was not significantly associated with PTSD or depression. The strongest predictor of increased odds was combat exposure for both PTSD (OR 2.28; 95% CI 2.00–2.59) and depression (OR 1.30; 95% CI 1.11–1.53). There was no statistical interaction between combat exposure with PTSD or depression. In the mental health referral model there was a significant interaction between combat exposure and referral ($p = 0.01$); stratified results are detailed in Table IV. For those with three combat exposures and relative to a DDR of <1:1, DDRs of 1:1 and 2:1 conferred a 49% (OR 0.51; 95% CI 0.27–0.97) and 92% (OR 0.08; 95% CI 0.01–0.59) reduced odds of mental health referral, respectively. In all three stratified regression models the Hosmer–Lemeshow test indicated a good fit ($p > 0.10$).

Because of the identified interaction, Figure 2 graphically presents mental health referral rates stratified by both DDR and combat exposure. Among those with three combat exposures, the referral rate was 9.6% (23/240) for those with the

TABLE III. Multivariate Logistic Regression Models for PTSD and Depression, U.S. Marines with Multiple Deployments to Iraq, Afghanistan, and/or Kuwait, 2005–2008 ($N = 3,512$)

Variable	PTSD ^a		Depression ^b	
	OR (95% CI)	<i>p</i>	OR (95% CI)	<i>p</i>
DDR				
<1:1	Ref		Ref	
1:1	1.00 (0.78–1.27)	0.98	0.94 (0.69–1.27)	0.68
2:1	0.92 (0.68–1.23)	0.57	0.81 (0.56–1.18)	0.28
Age (25+/18–24)	1.14 (0.86–1.51)	0.38	0.80 (0.55–1.17)	0.25
Rank (E6+/E1–E5)	0.46 (0.31–0.68)	<0.01	0.18 (0.08–0.38)	<0.01
Married (Yes/No)	1.11 (0.91–1.35)	0.32	1.21 (0.95–1.56)	0.13
Infantry (Yes/No)	0.75 (0.61–0.93)	<0.01	0.75 (0.58–0.97)	0.03
Time to PDHA	1.00 (0.99–1.00)	0.69	0.99 (0.98–1.00)	0.02
Combat Exposure	2.28 (2.00–2.59)	<0.01	1.30 (1.11–1.53)	<0.01
DDR/Combat Exposure ^c	–	NS	–	NS

NS, not significant. ^a $n = 60$ were excluded due to missing data. ^b $n = 12$ were excluded due to missing data. ^cInteraction term of DDR and combat exposure, no odds ratios calculated.

TABLE IV. Multivariate Logistic Regression Model for Mental Health Referral, and Interaction Between DDR and Combat Exposure, U.S. Marines, 2005–2008 ($N = 3,512$)

DDR	Mental Health Referral ^a OR (95% CI)
No. of Combat Exposures = 1 ^b	
<1:1	Ref
1:1	1.10 (0.48–2.52)
2:1	1.40 (0.59–3.28)
No. of Combat Exposures = 2	
<1:1	Ref
1:1	0.60 (0.29–1.26)
2:1	0.61 (0.26–1.24)
No. of Combat Exposures = 3	
<1:1	Ref
1:1	0.51 (0.27–0.97)
2:1	0.08 (0.01–0.59)

^aIn full model, adjusted for age, rank, marital status, infantry occupation, and time to PDHA, interaction between DDR and combat exposure was statistically significant ($p = 0.01$). ^bModel not adjusted for rank because of one cell having zero mental health referrals.

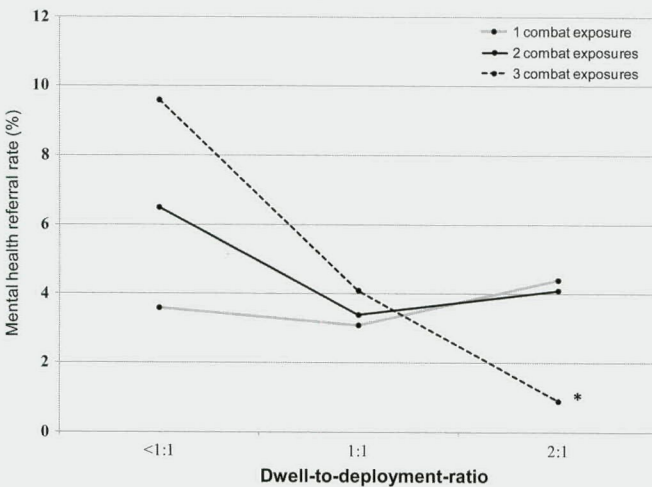


FIGURE 2. Mental health referral percentage, interaction between DDR and number of combat exposures, U.S. Marines, 2005–2008 ($N = 3,512$). * χ^2 test for differences in mental health referral rate across DDR category, $p < 0.001$.

lowest DDR of <1:1 compared with only 0.9% (1/113) among those with the highest DDR of 2:1. χ^2 testing found a significant difference in referral rates across DDR categories for those with three combat exposures ($p < 0.001$), but not for those with one ($p = 0.46$) or two ($p = 0.16$) combat exposures.

DISCUSSION

The effect of multiple deployments and dwell time on the mental health of military members is an emerging area of research. The present analysis found a protective effect of dwell time, but only for mental health referral in those with high levels of combat exposure. The association between increased dwell time and lower rates of referral may explain previous work that found a protective effect of dwell time

with diagnosed mental health disorders, including PTSD.¹⁰ The interaction between dwell time and combat exposure is a novel finding, and suggests that if a dwell-time policy is eventually adopted, it may be most feasible to have a gradual implementation, starting with those occupations expected to have high levels of combat exposure.

The primary finding of this analysis was that mental health referral, but not PTSD or depression screening outcomes, was inversely associated with dwell time. Information on factors that may prompt mental health referrals was not available for the present study, but is needed to thoroughly explain this relationship. Not everyone who screens positive for PTSD and/or depression receives a referral for mental health services. It may be that a referral for care is a proxy for more severe symptoms that are evident to the clinician reviewing the PDHA. This would suggest that dwell time may be effective in preventing the most serious psychological reactions to combat stress. Similarly, it is possible that a mental health referral is more indicative of clinical illness compared with screening instruments, which can be prone to false positives. It would be informative to know what specific guidelines are taken into consideration when determining a mental health referral, since previous research found that fewer than 20% of military personnel reporting a mental health problem on the PDHA were subsequently referred to mental health services.²²

The mechanism of how dwell time would prevent psychological morbidity remains unclear. It is possible that multiple combat deployments can act as chronic stressors. The result may be an increase in allostatic load, defined by McEwen as the “wear and tear” the body experiences when repeatedly exposed to stress.^{29–31} It is possible that dwell time interrupts the accumulation of chronic stress, both physical and mental, thus minimizing its overall impact. This may also explain why the association was only found in those with high levels of combat exposure, since intense stressors such as combat may be most likely to affect allostatic load. To fully test this hypothesis, studies targeted at measuring biomarkers for allostatic load would be needed. Another possibility is that certain experiences during dwell time can make a person more resilient for his or her second deployment, which may consequently reduce the risk of adverse mental health outcomes.³² We were unable to measure these experiences, which could include changes in social or financial status, having extra time for educational opportunities, or becoming better trained and more confident at one’s work. This suggests a new area of military health research that focuses on dwell exposures and experiences together with the more studied area of deployment exposures. Moreover, with the frequency of multiple deployments in today’s military, a conceptual model for overall health likely would include exposures for all deployments, coupled with dwell experiences and premilitary factors.

A primary strength of the present analysis was the multivariate adjustment for several demographic variables

significantly associated with dwell time, particularly combat exposure. The use of electronic records to calculate deployment length and dwell time was another strength, since these records have been shown to be highly correlated with self-reported information.³³ In addition, the ability to link the study sample to medical databases allowed for the exclusion of those with previous mental health disorder, a potential confounding variable.

A potential limitation is how dwell time was measured, which is still a subject of debate. In this analysis, as in one previous analysis,¹⁰ the ratio measure of DDR was used; however, there is not enough information in the literature to determine whether this is the most valid way to examine dwell time. Other classifications of dwell time should be explored in future analyses, such as cut points of dwell time at 1 year, 18 months, and so on, or leaving it as a continuous variable. Another limitation was the restriction of the study sample to Marines with average deployment lengths, which may reduce the generalizability of the results, though a previous analysis found that this restriction captured over 70% of all Marine Corps deployments.¹⁰ The results of the present study can only be generalized to Marine Corps personnel, and future studies need to examine other services, because the Air Force, Navy and Army have differing deployment lengths and experiences.

To our knowledge, this is one of the first studies to examine the issue of multiple deployments and dwell time while accounting for combat exposure. Among those with high levels of combat exposure, longer dwell times appeared beneficial in reducing rates of mental health referral. The mechanism of this association, as well as the effect of dwell time on other adverse mental health outcomes, needs to be explored further. In addition, specific experiences during an individual's dwell time may be as important as time between deployments on mental health outcomes and should be examined to identify key determinants of resilience. The issues of a dwell-time policy and whether certain high-risk occupations should be prioritized for increased dwell time are worthy of further discussion due to its potential health impact on the U.S. military. As extended military conflicts and multiple combat deployments continue, medical information should be combined with operational and logistical considerations to determine ideal deployment lengths and dwell times for military personnel.

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14. ABSTRACT <p>The conflicts in Iraq and Afghanistan have been the longest sustained military operations in U.S. history. To meet operational demand, many service members have had to deploy multiple times to these combat zones. The effect of dwell time, or the period of time between deployments, has recently gained attention because some studies have found that longer dwell times are protective against combat-related psychological outcomes. The objective of this study was to examine the association between dwell time and psychological morbidity, while accounting for combat exposure. U.S. Marines with two combat deployments between 2005 and 2008 were identified from electronic deployment records. Those who had screened positive for posttraumatic stress disorder and depression, and had received a referral for mental health services were identified from the Post-Deployment Health Assessment. For the final study sample of 3512 Marines, dwell time was calculated as time between deployments, and was analyzed as a ratio over length of first deployment. After adjustment for all covariates, there was an interaction (p value = 0.01) between dwell time and combat exposure on mental health referral outcome. For personnel with maximum reported combat exposure, longer dwell times were significantly associated with a 49–92% reduced odds of mental health referral. Longer dwell times may be protective against combat-related psychological outcomes. Since multiple deployments are likely to be the norm rather than the exception in future military operations, the concept of regulating dwell time, particularly for those with greater risk of combat exposure, should continue to be explored.</p>					
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